Amendments to the Claims:

The following listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Previously Presented) An automated simulation method for determining enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the Dirac coulombic tunnelling integral, comprising the steps of:

assigning the variable C to the ratio of the Poole-Frenkel barrier lowering energy (ΔE_{fp}) divided by the energy range for which tunnelling can occur (ΔE_n);

assigning the value (C+1)/2 to a variable v and performing a second order Taylor's series expansion of the Dirac coulombic tunnelling integral around v to determine a maximum value (u_{max}) for the variable u of the integral;

determining if the value for u_{max} is less than C, is between C and 1 or is more than 1;

assigning the value of C to the variable v if u_{max} is less than C;

assigning the value of u_{max} to the variable v if u_{max} is between C and 1;

assigning the value of 1 to the variable v if u_{max} is more than 1;

reducing the Taylor's series expansion of the Dirac coulombic tunnelling integral to an error function;

reducing the error function to simple exponential functions by applying rational approximations to the error function; and

calculating the enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the said simple exponential functions;

wherein said method determines the leakage current in a polysilicon Thin Film Transistor.

2. (Currently Amended) An automated simulation method which determines enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the approximated tunnelling equation set out ~~as equation 26 herein~~below:

$$\int_{t_l}^{t_u} e^{-t^2}\,dt = \frac{\sqrt{\pi}}{2}\left[erf(t_u) - erf(t_l)\right].$$

;

wherein said method determines the leakage current in a polysilicon Thin Film Transistor.

3. (Currently Amended) An automated simulation method which determines enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the approximated tunnelling equation set out ~~as equation 27 herein~~below:

$$erf(x) = 1 - (a_1 t + a_2 t^2 + a_3 t^3 + a_4 t^4 + a_5 t^5)e^{-x^2},$$

$$t = \frac{1}{1+px},$$

$$a_1 = 0.254829592;$$
$$a_2 = -0.284496736;$$
$$a_3 = 1.421413741;$$
$$a_4 = -1.453152027;$$
$$a_5 = 1.061405429;$$
$$p = 0.3275911;$$

;

wherein said method determines the leakage current in a polysilicon Thin Film Transistor.

4. (Canceled)

5. (Previously Presented) A simulator for determining enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the Dirac coulombic tunnelling integral, comprising:

means storing a variable C having a value equal to the ratio of the Poole-Frenkel barrier lowering energy (ΔE_{fp}) divided by the energy range for which tunnelling can occur (ΔE_n);

means which assign the value (C+1)/2 to a variable v and perform a second order Taylor's series expansion of the Dirac coulombic tunnelling integral around v to determine a maximum value (u_{max}) for the variable u of the integral;

means which determine if the value for u_{max} is less than C, is between C and 1 or is more than 1;

means which assign the value of C to the variable v if u_{max} is less than C;

means which assign the value of u_{max} to the variable v if u_{max} is between C and 1;

means which assign the value of 1 to the variable v if u_{max} is more than 1;

means storing simple exponential functions derived from applying rational approximations to an error function obtained by reducing the Taylor's series expansion of the Dirac coulombic tunnelling integral; and

means which calculate the enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device using the said simple exponential functions;

wherein said simulator determines the leakage current in a polysilicon Thin Film Transistor.

6. (Currently Amended) A simulator which determines enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device comprising means which calculate the approximated tunnelling equation set out ~~as equation 26~~ ~~herein~~below:

$$\boxed{\begin{aligned}\Gamma_n^{Coul} &= \frac{A}{2}\sqrt{\frac{\pi}{AI}}\left(\frac{a_1}{(1+pt_l)}+\frac{a_2}{(1+pt_l)^2}+\frac{a_3}{(1+pt_l)^3}+\frac{a_4}{(1+pt_l)^4}+\frac{a_5}{(1+pt_l)^5}\right)exp(-C^2AI - CAII - AIII)\\ &- \frac{A}{2}\sqrt{\frac{\pi}{AI}}\left(\frac{a_1}{(1+pt_u)}+\frac{a_2}{(1+pt_u)^2}+\frac{a_3}{(1+pt_u)^3}+\frac{a_4}{(1+pt_u)^4}+\frac{a_5}{(1+pt_u)^5}\right)exp(-AI - AII - AIII)\end{aligned}}$$

$$AI = -\frac{f''(v)}{2},\ AII = -[f'(v) - vf''(v)],\ AIII = -\left[v^2\frac{f''(v)}{2} - vf'(v) + f(v)\right],$$

$$t_l = \sqrt{AI}\left(C+\frac{AII}{2AI}\right),\ t_u = \sqrt{AI}\left(1+\frac{AII}{2AI}\right),$$

$$f(v) = Av - Bv^{\frac{3}{2}} + Dv^{-\frac{1}{6}},$$

$$f'(v) = A - \frac{3}{2}Bv^{\frac{1}{2}} - \frac{1}{6}Dv^{-\frac{7}{6}},$$

$$f''(v) = -\frac{3}{4}Bv^{-\frac{1}{2}} + \frac{7}{36}Dv^{-\frac{13}{6}},$$

$$A = \frac{\Delta E_n}{kT},\ B = K_n, C = \frac{\Delta E_{fp}}{\Delta E_n},\ D = BC^{\frac{5}{3}}.$$

$v = C$(for $u_{max} < C$, case 1),
$v = u_{max}$ (for $C < u_{max} < I$, case 2),
$v = I$(for $u_{max} \geq 1$, case 3),

$$u_{max} = \frac{f'(v) - vf''(v)}{f''(v)} \text{ for } v = \frac{C+1}{2}.$$

____;

wherein said simulator determines the leakage current in a polysilicon Thin Film Transistor.

7. (Currently Amended) A simulator which determines enhanced generation recombination rate due to trap-to-band tunnelling in a semiconductor device comprising means which calculate the approximated tunnelling equation set out ~~as equation 27~~ ~~herein~~below:

$$\boxed{\begin{aligned}\Gamma_n^{Coul} = &\frac{A}{2}\sqrt{\frac{\pi}{AI}}\left(\frac{a_1}{(1+pt_l)}+\frac{a_2}{(1+pt_l)^2}+\frac{a_3}{(1+pt_l)^3}+\frac{a_4}{(1+pt_l)^4}+\frac{a_5}{(1+pt_l)^5}\right)exp(-C^2AI - CAII - AIII)\\ &-\frac{A}{2}\sqrt{\frac{\pi}{AI}}\left(\frac{a_1}{(1+pt_u)}+\frac{a_2}{(1+pt_u)^2}+\frac{a_3}{(1+pt_u)^3}+\frac{a_4}{(1+pt_u)^4}+\frac{a_5}{(1+pt_u)^5}\right)exp(-AI - AII - AIII)\\ &\pm\frac{A}{2}\sqrt{\frac{\pi}{AI}}\exp\left(-AIII + \frac{AII^2}{4AI}\right)\end{aligned}}$$

______________________________________;

wherein said simulator determines the leakage current in a polysilicon Thin Film Transistor.

8.-18. (Canceled)

19. (Currently Amended) ~~The method of claim 1, comprising~~ A method of manufacturing a semiconductor device based on the leakage ~~current.~~ current estimated by the method according to claim 1.

20. (Currently Amended) ~~The method of claim 2, comprising~~ A method of manufacturing a semiconductor device based on the leakage ~~current.~~ current estimated by the method according to claim 2.

21. (Currently Amended) ~~The method of claim 3, comprising~~ A method of manufacturing a semiconductor device based on the leakage ~~current.~~ current estimated by the method according to claim 3.

22.-24. (Canceled)